



Understanding mRNA COVID-19 Vaccines

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What You Need to Know

- Messenger RNA (mRNA) vaccines teach our cells how to make a protein that will trigger an immune response inside our bodies.
- Researchers have been studying and working with mRNA vaccines for decades.
- Like all vaccines, mRNA vaccines benefit people who get vaccinated by giving them protection against diseases like COVID-19 without risking the potentially serious consequences of getting sick.

The Pfizer-BioNTech and Moderna COVID-19 vaccines are messenger RNA vaccines, also called mRNA vaccines. Learn more about [Pfizer-BioNTech](#) and [Moderna](#) COVID-19 vaccines, including who can get them, doses, and ingredients.

How mRNA COVID-19 Vaccines Work

To trigger an immune response, many vaccines put a weakened or inactivated germ into our bodies. Not mRNA vaccines. Instead, mRNA vaccines use mRNA created in a laboratory to teach our cells how to make a protein—or even just a piece of a protein—that triggers an immune response inside our bodies. This immune response, which produces antibodies, is what helps protect us from getting sick from that germ in the future.

1. First, mRNA COVID-19 vaccines are given in the upper arm muscle or upper thigh, depending on the age of who is getting vaccinated.
2. After vaccination, the mRNA will enter the muscle cells. Once inside, they use the cells' machinery to produce a harmless piece of what is called the spike protein. The spike protein is found on the surface of the virus that causes COVID-19. After the protein piece is made, our cells break down the mRNA and remove it, leaving the body as waste.
3. Next, our cells display the spike protein piece on their surface. Our [immune system](#) recognizes that the protein does not belong there. This triggers our immune system to produce antibodies and activate other immune cells to fight off what it thinks is an infection. This is what your body might do if you got sick with COVID-19.
4. At the end of the process, our bodies have learned how to help protect against future infection with the virus that causes COVID-19. The benefit is that people get this protection from a vaccine, without ever having to risk the potentially serious consequences of getting sick with COVID-19. Any [side effects](#) from getting the vaccine are normal signs the body is building protection.



Facts About mRNA COVID-19 Vaccines

mRNA COVID-19 vaccines cannot give someone COVID-19 or other illnesses.

- mRNA vaccines do not use any live virus.
- mRNA vaccines cannot cause infection with the virus that causes COVID-19 or other viruses.

They do not affect or interact with our DNA.

- mRNA from these vaccines do not enter the nucleus of the cell where our DNA (genetic material) is located, so it cannot change or influence our genes.

The mRNA and the spike protein do not last long in the body.

- Our cells break down mRNA from these vaccines and get rid of it within a few days after vaccination.
- Scientists estimate that the spike protein, like other proteins our bodies create, may stay in the body up to a few weeks.

mRNA COVID-19 Vaccines Have Been Rigorously Evaluated for Safety

mRNA vaccines are [safe](#) and [effective](#).

mRNA COVID-19 vaccines have been held to the same [rigorous safety and effectiveness standards](#)  as all other types of vaccines in the United States. The only COVID-19 vaccines the Food and Drug Administration (FDA) makes available for use in the United States (by approval or emergency use authorization) are those that meet these standards.

While COVID-19 vaccines were developed rapidly, [all steps have been taken to ensure their safety and effectiveness](#).

mRNA Vaccines Are Newly Available to the Public But Have Been Studied for Decades

Researchers have been studying and working with mRNA vaccines for decades. Interest has grown in these vaccines because they can be developed in a laboratory using readily available materials. This means vaccines can be developed and produced in large quantities faster than with other methods for making vaccines.

mRNA vaccines have been studied before for flu, Zika, rabies, and cytomegalovirus (CMV). As soon as the necessary information about the virus that causes COVID-19 was available, scientists began designing the mRNA instructions for cells to build the unique spike protein into an mRNA vaccine.

Future mRNA vaccine technology may allow for one vaccine to provide protection against multiple diseases, thus decreasing the number of shots needed for protection against common vaccine-preventable diseases.

Beyond vaccines, cancer research has used mRNA to trigger the immune system to target specific cancer cells.

Use [CDC's COVID-19 booster tool](#) to learn if and when you can get boosters to stay up to date with your COVID-19 vaccines. [Staying up to date](#) means getting all recommended COVID-19 vaccines including boosters when eligible.

[People who are moderately or severely immunocompromised have specific COVID-19 vaccine recommendations](#), which include a third dose to complete their primary series, as well as two booster doses for those eligible.

Learn More About mRNA Vaccines

INFOGRAPHIC
How mRNA COVID-19 Vaccines Work

PDF infographic explaining how mRNA COVID-19 vaccines work.

- [English](#)  [128 KB, 1 page]

How mRNA COVID-19 Vaccines Work

Understanding the virus that causes COVID-19.

Coronaviruses, like the one that causes COVID-19, are named for the crown-like spikes on their surface, called **spike proteins**. These **spike proteins** are ideal targets for vaccines.

What is mRNA?

Messenger RNA, or mRNA, is genetic material that tells your body how to make proteins.

What is in the vaccine?
The vaccine is made of mRNA wrapped in a coating that makes delivery easy and keeps the body from damaging it.

How does the vaccine work?

The mRNA in the vaccine teaches your cells how to make copies of the **spike protein**. If you are exposed to the real virus later, your body will recognize it and know how to fight it off.



The vaccine **DOES NOT** contain ANY virus, so it cannot give you COVID-19. It cannot change your DNA in any way.

When your body responds to the vaccine, it can sometimes cause a mild fever, headache, or chills. This is completely normal and a sign that the vaccine is working.

After the mRNA delivers the instructions, your cells break it down and get rid of it.

Antibody

GETTING VACCINATED?
For information about COVID-19 vaccine, visit: [cdc.gov/coronavirus/vaccines](https://www.cdc.gov/coronavirus/vaccines)



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COVID-19 Clinical and Professional Resources

More Information

[How Long Do mRNA and Spike Proteins Last in the Body?](#)



[FDA's Emergency Use Authorization for Vaccines Explained](#)



[Johns Hopkins: How Do mRNA Vaccines Work? \[00:01:48\]](#)

[FDA Infographic: The Path for a COVID-19 Vaccine from Research to Emergency Use Authorization \[724 KB, 1 page\]](#)

[PBS Newshour: How Do mRNA Vaccines Work? \[00:02:27\]](#)



[FDA's Vaccine Development 101](#)



[Infectious Disease Society of America: mRNA Vaccines](#)

